

CLAIMS

What is claimed is:

1. A shock absorber piston assembly, comprising:

a shock absorber piston having a first face and an opposed second face;

a plurality of fluid passages extending between the first face and the second face; and

a plurality of valves externally attached to the piston, including:

at least two rebound valves, each connectable to at least one of the fluid passages; and

at least two compression valves, each connectable to at least one of the fluid passages;

wherein each of the valves actuates at an individually adjustable valve opening pressure.

2. The piston assembly of Claim 1, wherein each of the valves comprise:

a pin; and

a compressible device connectable to the pin, the compressible device being compressible to operably position the valve between a closed position and an open position.

3. The piston assembly of Claim 2, wherein each of the compressible devices comprises a spring defining a spring rate selectable to vary the valve opening pressure.

4. The piston assembly of Claim 2, wherein each compressible device of each rebound valve comprises a coiled spring defining a spring rate selectable to vary the valve opening pressure between individual ones of the rebound valves.

5. The piston assembly of Claim 2, wherein each compressible device of each compression valve comprises a coiled spring defining a spring rate selectable to vary the valve opening pressure between individual ones of the compression valves.

6. The piston assembly of Claim 1, comprising a bleed disc included with at least one of the valves.

7. The piston assembly of Claim 2, wherein each of the valves comprises:

a pin connection end;  
a washer slidably connected with the pin connection end; and  
a fastener fastened at the pin connection end, the fastener operably engaging the washer with the compressible device.

8. The piston assembly of Claim 7, wherein the fastener comprises a threaded nut operable to vary a preload of the compressible device.

9. The piston assembly of Claim 7, comprising at least one shim disc disposed between the washer and the compressible device to vary a preload of the compressible device.

10. The piston assembly of Claim 1, comprising:  
a shock absorber fluid in contact with both the first face and the second face;  
wherein each of the rebound valves is operable to control a first direction flow of the shock absorber fluid from the first face toward the second face; and  
wherein each of the compression valves is operable to control a second direction flow of the shock absorber fluid from the second face toward the first face.

11. A shock absorber, comprising:

a tube forming a pressure chamber and operably containing a fluid;  
a piston assembly slidably positionable within the tube, the piston assembly dividing the pressure chamber into a first working chamber and a second working chamber, the piston assembly including:

(i) a piston defining a plurality of fluid passages extending between the first working chamber and the second working chamber;

(ii) at least two rebound valves attached to the piston operably controlling a flow of the fluid from the first working chamber to the second working chamber; and

(iii) at least two compression valves oppositely attached to the piston from the rebound valves, the compression valves operably controlling a flow of the fluid from the second working chamber to the first working chamber;

wherein each of the rebound valves and the compression valves are individually preset to open over a plurality of valve opening pressures such that the rebound valves open in a rebound valve successive order and the compression valves open in a compression valve successive order.

12. The shock absorber of Claim 11, wherein the fluid comprises a gas.

13. The shock absorber of Claim 11, wherein the fluid comprises a hydrocarbon based liquid.

14. The shock absorber of Claim 11, wherein each of the rebound valves and the compression valves comprise:

a pin;

a compressible device connectable to the pin;

a washer mechanically linking the compressible device to the pin;

and

a valve plate engageable with the piston operably sealing one of the fluid passages of the piston in a closed position of one of the rebound valves and the compression valves.

15. The shock absorber of Claim 14, wherein the piston comprises a land adjacent each of the fluid passages, each land operably engaged by the valve plate in the closed position of one of the rebound valves and the compression valves.

16. The shock absorber of Claim 14, wherein the compressible device comprises a spring.

17. A shock absorber, comprising:

a piston tube;

a piston assembly slidably disposed within the piston tube and

operably dividing the piston tube into a first working chamber and a second

working chamber, the piston assembly including:

a shock absorber piston having a first face and an opposed  
second face;

a plurality of fluid passages extending between the first face  
and the second face; and

a plurality of valves externally attached to the piston,  
including:

at least two rebound valves, each connectable to at least  
one of the fluid passages; and

at least two compression valves, each connectable to at  
least one of the fluid passages; and

a piston rod fastenably attached to the piston assembly.

18. The shock absorber of Claim 17, wherein the piston rod comprises  
a first end fitting connectable to an axle assembly of an automobile vehicle.

19. The shock absorber of Claim 17, comprising:
  - a tubular end slidably disposed over both the piston tube and a freely extending end of the piston rod; and
  - a second end fitting fixedly connectable to the freely extending end of the piston rod and operably connecting the shock absorber to a vehicle body of an automobile vehicle.

20. A method to dampen an automobile vehicle ride deflection, the vehicle having at least one shock absorber, each shock absorber having a piston with a first face and a second face and a plurality of through fluid passages, the method comprising:

orienting at least two rebound valves with select fluid passages of the piston to open toward the first face of the piston;

arranging at least two compression valves with select fluid passages of the piston to open toward the second face of the piston;

adjusting each of the rebound valves to open sequentially upon exposure to a predetermined set of increasing first face fluid pressures; and

preconditioning each of the compression valves to open sequentially upon exposure to a predetermined set of increasing second face fluid pressures.

21. The method of Claim 20, comprising preloading a spring in each of the compression valves and the rebound valves during the adjusting and the preconditioning steps.

22. The method of Claim 20, comprising shimming at least one of the compression valves and the rebound valves.

23. The method of Claim 20, comprising varying a diameter of at least one of the fluid passages.